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FEB., 1944

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J. I. Rodale, Editor | Sir Albert Howard, C.I.E., M.A., Associate Editor

With The Editor

In Defense of Plowless Farming

BY EDWARD H. FAULKNER

Author of—Plowman's Folly (Univ. of Oklahoma-Press)

LET me say, Mr. Rodale, that your article "To Plow or Not to Plow" in December Organic Gardening meets the issues fairly; which I cannot say of a good deal of the critical writing I have seen. You mention real objections; but each of the objections you bring is answerable. I shall try very briefly to point out the answers.

I shall waive the statement that "it (the plow) is a safe and efficient tool where compost is used in the soil as the fertilizer element". You know more about compost than I do. I believe, though, that the incorporation of raw organic matter into the soil surface—when this is done in such a manner as to distribute the material evenly through the soil surface—is the full equivalent of using the best of compost in the surface. I say this because in my experience I have seen some of the best vegetables it is possible to produce; and I have never seen any that were superior to what can be produced in this manner from soil otherwise very ordinary in productive capacity.

The point that weeds "had a field day" is well taken. Weeds *are* stimulated fully as much as is the crop you wish to grow. My conclusion is not that we should, therefore, return to plowing, but that we should put up a real man-sized fight against weeds. My own training on the farm included such strenuous measures of weed control that I did not realize, when writing Plowman's Folly, that other people fought them less strenuously; so, I did leave

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myself open to criticism on that score. Nevertheless, if we organize for weed destruction there is every reason why we should be able to whip them.

Grain drills of the "hoe" type are at a disadvantage in the disced surface. This means, not that we should surrender our right to grow crops in an improved surface; but that we should see to it that manufacturers devise drills that will handle the situation. There are no problems involved here that begin to compare in complexity with many that are encountered daily in industry—even in the publishing business, I dare say. Indeed, there are already available disc grain drills, designed to operate in a reasonable amount of trash. Such a drill would do a better job than the hoe type that drags the trash along.

When farmers say they plow because in that way they get rid of weeds, they do not realize that the underlying reason why the weeds do not grow so vigorously is that the plowing creates *temporary desert conditions* that are less favorable both for the weeds and the crop. It is really easier to fight weeds in this temporary desert.

The reason I made no mention of the compacting done by the tractor is that this is related not to the weight of the tractor but to the structure of the soil. A soil of proper structure would be springy, and would not be seriously compacted by the weight of the tractor any more than would the spongy forest floor. The properly filled soil will have somewhat the feel of a mattress when you walk over it. I have not achieved this yet on field scale, but it became evident on my lawn, as a result of several seasons' work. There is no need then to decry the tractor for damage it does to a soil, when that damage results from the condition of the soil itself. Plowed soil, I might say, is as easily compacted again as if it had not been plowed. Any one who has observed such things will know that, when he stops to think of it.

May I suggest that the Wisconsin tests which showed a slightly smaller corn yield, where the organic matter had been disced-in, than where it had been plowed-in, would probably have resulted in the opposite way if the land had previously been effectively cleared of weeds. You see, when we quit placing the corn's food supply in the plowsole (six to eight inches below the surface) and start leaving all the rotting material right in the upper few inches (where our cultivator teeth run) we are inviting the corn to change its rooting habits, and are making it certain that the roots will be seriously damaged by the cultivation. I presented the idea in this manner to the Soil Science Society of Indiana some weeks ago, and none of the soil experts raised any objection. The conclusion, then, is not that we should plow for corn, but that we should rid our corn land of weeds to such an extent that we will not have to do cultivation after the crop has reached a foot in height.

Certainly, tests (conducted in land that has been plowed) showed that there was little or no capillary movement upward. There really is no upward capillary movement in plowed soil. The reason for this is that the material plowed in acts as a blotter, and very quickly robs those upper inches of the soil of all its movable moisture. The man who claims seriously that there is no capillary movement of water toward the soil surface in unplowed soil must account for the fact that the surface of the earth (everywhere except where the land has been plowed) supports vegetation. This vegetation certainly could not remain green for ten minutes on a hot day unless there were continuous effective capillary connection to provide the water.

You mention the Rototiller, which is, indeed, an excellent implement. I did not mention it because of its limitations when tall green manure crops are concerned. It simply will not do what the disc harrow will do in that one instance. On the other hand, it *will* handle sods, which the disc harrow will usually not do. The one most important objection to the rototiller for general farm work is its extremely high cost. Mr. Kelsey of Rototiller tells me that he expects to produce in quantity, as soon as the war is over; and expects to have the price within the reach of average purchasers.

I have not had a chance to see the work of the disc plow, but feel sure that it will do an acceptable job, provided its work is followed up by the rototiller or the disc harrow. It will open up the land, but I don't believe farmers usually expect to plant the land without further treatment following the disc plow.

I thank you for this opportunity to further discuss this matter. And may I remark now about your December issue. The use of the House of Lords debate is a most excellent thing, it seems to me. I have already read sections from the debate on my radio program, giving credit to Organic Gardening, Emmaus, Pa.

Answer to Letter

Dear Mr. Faulkner:

THE main problem with the question of the plow is that soil conditions vary so radically in different parts of the country that you cannot generalize. There are some sections and some soil, as described in my original article, where the disc may safely take the place of the plow, but in many other places such a course may prove disastrous.

I met a farmer at our frozen food locker only a few days ago who farms over 300 acres. He brought the subject up himself. He said, "I hear there is a fellow who is against plowing. That won't do here in the Lehigh Valley. Our soil is very clayey and the soft part of the soil extends down only about six inches. The disc won't loosen the soil below that level. I have found that you must go deeper than that with your plow and loosen some of the hard clay underneath otherwise the rains will not penetrate further than the top six inches and will wash off the land. I have seen it happen."

In bringing this matter to the attention of another farmer he said, "Years ago I bought a small tract of land near here for truck farming. Friends laughed at me for purchasing it because the soil was so hard that rains would stand on it for days without getting absorbed. But I fooled em. I set out sticks of dynamite every 3 feet. Each stick cost me only 8 cents and I made four charges out of each one. These explosions stirred up the sub-soil beautifully and I had a marvelous crop of cabbages." If you were to depend only on discing in such soil you could not do any practical farming.

This brings to mind an experience in subsoiling which shows the value of stirring up the hard lower levels of soil. F. Sykes, a well-known farmer in England who has followed Sir Albert Howard's organic methods for years on thousands of acres, and who has produced spectacular results, suggests plowing twice instead of once, provided you sub-soil the land. In an article in Organic Gardening he said, "Yes, there was a lot of encouragement everywhere. But my knowledge of farming has told me two things —that you cannot farm without the plough, and that its full value can only be obtained if its operations are preceded by those of the subsoiler. To prove this one of many such stories will suffice. The subsoiler broke down after only part of a field had been done—no time to repair it, so ploughing and re-seeding with barley followed. The few acres that had been subsoiled grew a splendid crop, the rest of the field practically nothing. The next year the whole field was fallowed and subsoiled, and wheat was sown. The crop is now to be harvested and is one of the best in the county. Its yield is estimated at 56 bushels to the acre. Subsoiling did all this improvement.

"The details of farming technique which I have devised are important:

1. Subsoiling 2 feet deep.
2. Several ploughings.
3. Several harrowings.
4. Thorough land cleaning.
5. Two heavy roller rollings.

"The subsoiling 2 feet deep aerates the subsoil and splits into fragments the underground colloidal pan, thus opening up an unlimited store of mineral plant food which the deep-rooting varieties will seek in a very short time. The ploughings and other cultivations aerate the top five inches of topsoil and work down a fine tilth, which is indispensable to a good grass establishment."

I question the statement in the second paragraph of your letter in which you say, "I believe, though, that the incorporation of raw organic matter into the soil surface—when this is done in such a manner as to distribute the material evenly through the soil surface—is the full equivalent of using the best compost in the surface." It is a well-known fact in organic farming that finished compost is ready to go to work immediately in the soil. It is just teeming with bacteria. It can act as an inoculant to break down other organic matter, which is done by the bacteria in the compost. I have proved this in handling chicken droppings, as described in the November, 1943 issue of Organic Gardening. You can't do this with raw organic matter.

The same principle holds good in soil practice. It takes time for the soil to digest organic matter and if it is plowed under, it will decay faster than if it is merely incorporated in the surface. Many a farmer has wondered why his crop yield was affected negatively immediately after plowing under a green manure crop (raw organic matter in the form of green plants such as clover,

rye, etc.). The answer is that part of the soil bacteria had to spend time breaking down the green matter at a time when they were needed to work for the roots of the new crop. If his land had been extremely fertile it might not have interfered at all, however, because a fertile soil has a high degree of digestibility of such matter; it has more and livelier bacteria.

In your fifth paragraph you state that "plowing creates *temporary desert conditions* that are less favorable both for the weeds and the crop. It is really easier to fight weeds in this temporary desert." You admit then, that by plowing it is easier to obtain mastery over weeds. On the other hand, whether such "desert conditions" actually exist or if they do, are crops affected by them in a serious manner, is a highly theoretical question. We must be guided by practical considerations. If all of the obstacles can be removed, if the weed problem can be solved, if the right kind of discing tools can be designed, with a view especially of handling heavy clay soils, with the proper seed drills available which can seed in surface trash, then I believe there would be an advantage in adopting your idea more generally, although perhaps not quite 100%.

Whether a "desert condition" which might exist for a few days is actually harmful to the crop, may be considered and compared with the method of growing seedlings for transplanting. The conditions under which such seedlings are grown are entirely different with those existing in the field after the transplanting has been effected. For example, in the first stage they could be grown in the dark without harm. The seedling is endowed by nature with a certain amount of nourishment, even including some moisture, and can take care of itself under adverse conditions for a limited time, perhaps the time of the "desert" stage to which you refer. At any rate wonderful crops have come in many cases from such a beginning.

You have drawn attention in your book to the weeds growing by the wayside, how beautifully they thrive, without plowing. You overlook the fact, however, that weeds have grown that way for thousands of years, that they are hardy types of plants, used to growing under adverse conditions. Plant a few wheat or oat seeds among the weeds and you will find they will probably get choked out before maturing. Cultivated crops and weeds are two different things entirely. Secondly weeds may look nice and green from the distance, but come close and you will see rather thin stands, nothing to compare with the thick stands of cultivated crops such as wheat, oats, barley, etc. growing on plowed land.

In your seventh paragraph you make a serious charge against your theory. If you "start leaving all the rotting material right in the upper few inches (where our cultivator teeth run) we are inviting the corn to change its rooting habits, and are making it certain that the roots will be seriously damaged by the cultivation," and then you say "we should rid our corn land of weeds to such an extent that we will not have to do cultivation after the crop has reached a foot in height." That is a pretty large order. With conditions as they are on the average farm how can you make such a clean sweep of weeds? In the meantime your roots are feeding closer to the surface and are in danger of being damaged by the cultivator.

In your next paragraph you state again the point that you have made very strong in your book, namely that the surface green matter is plowed under evenly to the plow sole depth, and is a tight flat barrier preventing the water from below from reaching the surface by the usual capillary action of the soil. The Jefferson Farm Bureau News in a recent issue said, "Faulkner says that in plowing, the residues turned under always lie as a mat at the bottom of the furrow, thus definitely and effectively insulating the furrow-slice from its subsoil. Any good plowman would object most strenuously to such a premise."

Professor Charles E. Kellogg in his book "The Soils that Support Us" (Macmillan) says, regarding this point, "In good plowing the soil is not turned bottom-side-up, but a little less than completely over. . . . In plowing, it is better to have the organic matter somewhat mixed with the whole surface soil." I have walked behind the plow and have watched how that instrument buries the surface trash in a most ununiform manner.

In this same paragraph you talk about capillary movement of moisture. While this exists it is not considered much of a factor by soil experts. In fact they have made fun of it. F. L. Duley, Senior Soil Conservationist at Lincoln, Nebraska, in "The Land" recently took a rap at this theory by recalling an amusing incident which occurred at an old time Farmers' Institute meeting in his home

state of Missouri. "The Institute lecturer was painstakingly explaining how frequent cultivation of corn would bring up capillary water from below and thus rescue the crop from drought. After he had gone on at great length and apparently thought he had convinced everyone of his hearers as to the scientific soundness of the capillary idea, an old Ozark farmer put up his hand, raised slightly out of his seat, and said, "Eh, puf-fesser! How much do ye think ye'd have to cultivate tu make 'er too wet to plow?"

There are other minor disadvantages, one of which is the corn borer menace. You are no doubt familiar with Vice President Wallace's recent letter to Henry Ford about your book in which he says, "Faulkner's method will not work at all in combatting the corn borer. The very essence of combatting the corn borer is to make sure that there is absolutely no rubbish left on the surface of the ground in the spring of the year." Where the ground is thoroughly enriched with compost, however, there is much less to fear of this pest.

To me, more important than the method of working the soil, is what you put into it. If you enrich the soil with humus and stimulate its biologic life there will be little to fear whether you use a plow of disc, provided you use the organic method for a sufficient length of time to bring about a springy, spongy soil structure. It has been found also that when such a point is reached nature restores a proper balance as far as weeds are concerned and considerably reduces their activities.

In concluding I want to say that although I disagree with some of your ideas regarding the plow, I want to unhesitatingly recommend your book to all readers of ORGANIC GARDENING. Its challenging discussion of the general principles of soil fertility from an organic viewpoint is a valuable addition to the literature on the subject. I am convinced of your love of the soil and your sincere desire to save agriculture from its "friends" as well as its enemies. I also want to thank you for the many subscriptions we have received through your radio program recommendations.

This friendly battle of words isn't going to solve the question. Your book is receiving very wide distribution which it justly deserves. Here and there brave farmers and gardeners are going to try your method, some boldly and some warily. The U. S. Government is going to experiment too. In a few years there will be a definite answer.

J. I. Rodale

Are Ants Intelligent?

SOME kinds of ants are farmers. They plant fungus gardens and harvest the crop. Other ants are called Harvester ants, and they collect vast quantities of seeds and grain, which they store in underground granaries. They even spread the grain out to dry before storing it, so it will not become moldy.

Most remarkable of all, they show almost human sagacity, by biting off one end of each seed, thus preventing it from sprouting underground.

Another species of Harvester ant, a larger kind, are the grain crushers for the colony. These have large jaws, with which they crush the grain or seeds, so the smaller ants can get at the food inside.

It is said, that at least eighteen different kinds of seeds have been found in these ant granaries.

Another species of ant, called Leafcutters, raise their own crop. The workers carry bits of vegetation into the nest and arrange it in a seed bed, and on this the queen plants a tiny speck of fungus.

The workers then busily fertilize this "crop," by spreading dung of certain caterpillars over the "bed." Sometimes the queen breaks open her first eggs, to provide extra nourishment for the "garden."

In some very mysterious way, the workers then "treat" the garden so tiny white swellings, like minute cabbage heads, grow on the fungus. These "cabbages," the ants eat for food.

Scientists have grown exactly the same fungus in their laboratories but have never mastered the problem of producing the "cabbages." This is still the secret of the intelligent ants.— Ila Marie Baird.—*Our Dumb Animals Magazine.*

Creosote Injurious to Plants

BY LINUS H. JONES

Contribution No. 490 of the Mass. Agr. Exp. Station
(Amherst, Mass.)

THE growing scarcity of rot-resisting lumber, such as chestnut and cypress, and its increasing price, may tempt growers of plants to use wood preservatives on inexpensive lumber for flats, bench boards, hotbeds and coldframes. Creosote is probably the most readily available of such preservatives and its record of achievement commends it.

However, such treated wood should not be used in conjunction with growing plants, particularly seedlings. Creosote is a mixture of chemicals, several of which are volatile at high temperatures, giving off fumes which are harmful and even deadly to plants. The results of an investigation of the effects of chemically treated lumber on plant development are so definite in confirming unfortunate and unpublished experiences that the general public should be warned of the hazards involved. The tests were conducted in the Department of Botany of the Massachusetts State College and have been sufficiently checked to warrant certain conclusions.

In all probability the toxic agent is air borne and dependent upon a high air temperature, close to 100 degrees Fahrenheit, for volatilization. Poor ventilation, which could frequently occur when a pane of glass is used over a seed flat, or delay in lifting the sash of hotbeds and coldframes, would combine with a high temperature to cause considerable injury and even death to the plants. Since both creosote and illuminating gas are products of coal distillation, it is not surprising that the injury symptoms are similar.

Young tomato plants are used frequently to detect small quantities of illuminating gas because they give a striking response called epinasty, i.e., a downward growth of the midvein giving the leaf a convex shape. The same response is obtained with tomato plants and creosoted lumber. Other discernible responses to both creosote and illuminating gas are the quick maturity of the older leaves and their abscission. Young leaves are not injured and thus injury from illuminating gas or creosote can be differentiated from frost injury, which is severe on the younger leaves.

Possibly the most characteristic and the most general effect of creosote injury is leaf roll, which is a curling upward and inward of the marginal area to the extent that a portion of the original lower surface frequently becomes the upper surface. The cotyledons of seedlings are especially susceptible to this response as exemplified with plants of tomato, tobacco, lettuce and cabbage. The injured cabbage plants in Figure 1 are in a box made of wood treated with c r e o s o t e at least six months prior to planting. Figure 2 shows plants from untreated boxes. Injury was apparent four days after the plants had emerged from the soil, or one week after the seed was planted. The photographs were taken three weeks after the seeds were planted. These plants were not grown in a coldframe, h o t b e d, or any chamber with a small amount of air. They were grown in a greenhouse with well-controlled temperature and ventilation.

Creosoted wood completely buried in the soil has failed to cause injury to plants known to be injured by air-borne fumes. However, wherever growing plants are concerned, there is seldom an opportunity to protect lumber by creosote and keep it covered with soil so that it will not be exposed to the action of sun and air currents.

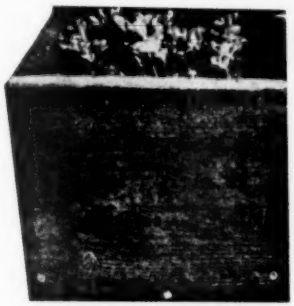
It may be of interest to read-

ers to learn of certain cases where injury to plants has been traced to creosote fumes. Plants have been severely injured or killed where coldframes and sash were treated with creosote. In one instance, a tobacco grower lost most of his seedlings. Another man, a backyard gardener, lost his early plantings of vegetables and flowers.

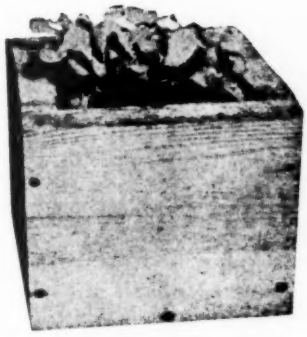
A report, direct from a grower of tobacco, stated that the lumber for a new tobacco coldframe was painted with creosote in the Autumn and exposed to the weather all Winter. Even this exposure was not sufficient to rid the lumber of the toxic agent.

Fumes from creosoted lumber used in a greenhouse bench are known to have killed potted plants in the next bench. Creosoted lumber, used as supports to benches, has been a source of injury when the heating pipes were close enough to volatilize the creosote. The fact that creosoted wood does not injure the first plantings is no guarantee that the creosote is not dangerous or the plants immune.

Creosoted flats have been used successfully in the Winter and very early Spring, but with the natural rise of temperature and radiant heat effect from the sun in late Spring, serious injury has resulted.



Cabbage plants in boxes treated with creosote.



Plants started at the same time in untreated boxes.

—Linus H. Jones.
Amherst, Mass.

Animal Instinct

From "The Spectator," (London) October 17th, 1941.

Sir,

A dig-for-victory plot on the edge of a golf-links was limed, planted and treated with artificials. Luxuriant heavy-green cabbages, sprouts and other vegetables resulted. To increase the family meat ration, part of this crop was fed to rabbits, who ate without relish, became apathetic and smelt unpleasantly. When later grass mowings were substituted the rabbits ate voraciously and became vigorous and sweet-smelling.

A correspondent writes: "Cabbages and sprouts grown too fast with nitrate and phosphate are a curious 'wrong' colour. If over 50 per cent. of the greenstuff given to rabbits is of this sort the rabbits die. Permanent pasture dressed with phosphate produces a luxuriant field. If the phosphate goes beyond a certain point the field takes on an unnatural green, and is deserted by wild rabbits."

Salesmen use this fact as a recommendation. One told me: "Use any soluble phosphate fertiliser and keep the rabbits away." Another said: "Use enough nitro-chalk and you will get big greens that rabbits will scarcely touch: if they do, they die." Animal instincts may be sound guides to food values, which are actually soil values, because food is nothing more than the "conveyancing agent" or "agent of transfer" of the soil's qualities into the bodies of man and beast; land in good heart supporting bodily health, vigour and stamina; poor unbalanced soils producing ill-health and debility. For instance, the liking of birds for hips, haws and many other hedgerow fruits has led to the discovery that these contain high concentrations of mineral salts, vitamins, and other essential food elements.

T. H. Sanderson-Wells,
(Chairman Food Education Society).
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Inorganic Fertilizers

A chapter from the book The Compost Gardener

BY F. C. KING

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Kendal, England.

WE come now to a class of artificial manures, dear to the heart of most amateurs, but dearer to their pockets, namely chemical fertilizers.

Nitrate of Soda

This is a very soluble nitrogenous manure which is always applied to a growing crop. Its action is forcing and of short duration. The effect on Spring Cabbage can be observed in three or four days after sprinkling a little round the plants; the foliage turns a deep green and the plant enters a period of rapid growth. The exhibitor at flower show will find many uses for nitrate of soda; by its use Onions will increase in size out of all recognition and every kind of vegetable will respond to frequent small sprinklings. If one is prepared to judge by appearance only, it would seem that in nitrate of soda we have a very valuable aid to success, but that, I am afraid, represents only a small portion of the balance sheet. The use of nitrate of soda will produce a "proud" plant, and pride goes before a fall. There is an old saying that whatever attacks plants "knows what's good." I believe the reverse is the case, and the plants that are not good are the plants attacked. Let me give an instance.

A gardener whose Cabbages were not doing well gave his plants a sprinkling of nitrate of soda, to which they duly responded; later the whole crop was ruined by caterpillars. The Cabbages in a nearby garden which received no nitrate of soda were not affected by caterpillars, although both sets of plants came from the same seed bed.

Wood pigeons seldom attack young plants of Cabbage, Cauliflower or Sprouts if they are healthy, but will choose any that are infested with club root, gall-weevil, or plants suffering from a check due to faulty transplanting, particularly if they have been artificially watered after planting.

I can quite understand market gardeners making free use of nitrate of soda, for by its use a crop of Spring Cabbage for instance can be pushed on to give an early crop to catch the market at its best and also to enable the ground to be cleared quickly and planted with some other crop, but I cannot understand a cottager or an allotment holder using a stimulant to gain a few days, for if crops are grown on fertile soil the gain is only a very few days, and he or she probably fails to replant or sow another crop, and is content to leave the old stalks in the ground until the autumn, so that the few days' gain in the spring results in the total loss of space for the rest of the season.

Sulphate of Ammonia

Sulphate of Ammonia often produces serious and lasting results. There is a distinct connection between plants grown with the help of sulphate of ammonia and certain plant pests. The use of this artificial is recommended for leafy crops and it is a significant fact that where it is used club root and gall-weevil will be found. By its use the land is robbed of lime; it soon becomes acid and sour, unless lime is repeatedly used. Some forms of lime burn up the humus in the soil, again making the soil poor and rob-

bing it of a powerful and natural pest protector.

There are other kinds of nitrogenous artificial manures which supply nitrogen, many of which I have tried, but I have yet to find one which does not do more harm than good, or one that I can recommend.

Phosphatic Manures

The next group of artificials embraces those that supply phosphoric acid, or the phosphatic manures. Of these the best known and most widely used are basic slag and superphosphate of lime. I have used considerable quantities of both and was quite satisfied at the time that I had done a wise thing; now I am patiently retracing my steps and building up the fertility of the soil under my charge on a surer foundation. The good effects from the use of these artificials were not maintained and the deterioration of the land was so marked that I had no option but to discontinue their use.

The first indication of something being wrong was observed in the earthworms. Not only were they less in number, but the varieties changed; instead of the good red lob worm, the garden began to be infested with the long black-headed worm and later by worms which were nearly white. Seldom in digging over a piece of ground was it possible to see a healthy vigorous worm, by far the greater number being knotted up like a ball, incapable of performing their most vital task of burrowing deep and thereby assisting in draining and aerating the soil. All this occurred during a period when plenty of farm-yard manure was available and was being used on the land. The physical character of the soil changed rapidly owing to the souring influence of slag and superphosphate. The land had to be caught just in the right condition for working, otherwise it became knotty. Trenching and ridging were undertaken every year to try and improve the texture, yet each spring found the surface sullen and harsh. The garden was infested with slugs to such an extent that every bit of green leaf was eaten by them; 10,000 Onions disappeared in less than a week, and they even climbed the Gooseberry bushes and stripped off the leaves; Potatoes at lifting time were mere shells and few were fit to store. Since discontinuing the use of these two artificials the garden is gradually returning to a workable condition, except where Potatoes have been most frequently grown and where superphosphate was used regularly. These portions are still stubborn, working badly in the spring, caking badly in the summer and producing much below their capacity.

This leads me to believe that probably the mineral superphosphate was more responsible for the bad effect on my soil than was the slag, but as I am getting much better results without either slag or superphosphate I can only conclude that they were valueless to me.

Another very significant fact came to light in the behaviour of the weed crop. Groundsel, for instance, flowered when about two inches high and the same piece of ground produced from three to four crops during summer and autumn. Daisies appeared—another sign of sour land. Amongst the vegetable crops, Cauliflowers buttoned very early, Cabbages grew hard and tough, Peas were short in growth and Lettuce leathery. On a particularly bad piece of ground, years after the land had been dressed with basic slag and superphosphate of lime for previous crops, a mile of Onions was a complete failure. The ground regularly received a full dressing of lime, which however failed to correct the acidity caused by the artificials.

I am satisfied that the death of the earthworms and soil bacteria was due to the use of these chemical manures and that they were directly responsible for the destruction of the soil texture. During the years when these artificials were being regularly used, labour was abundant and no routine of good cultivation was neglected; yet with ample labour and an adequate supply of farm-yard manure, combined with the use of artificials, the garden became sick and produced inferior crops.

Potassic Manures

Finally, I should like to say a little about potassic manures. The chief source of supply of potash salts is Germany. These are marketed as kainit, muriate of potash, sulphate of potash, etc., but as they all come from the same mine, though they vary considerably in price, there is little to choose between them. The difference in price is merely a question of the quantity of impurities they contain. The higher the price per hundredweight, the less the impurities, but at best, as in the case of muriate and sulphate, they contain more than fifty per cent. impurities, while in the case of kainit the percentage of waste is 88 per cent. It should be clearly understood that these impurities are very detrimental to plant life and are, in fact, definitely poisonous in most cases. For the most

part they are too dangerous for amateurs to use, although forms of potash are constantly being recommended for such crops as Onions and Tomatoes.

Let us examine the facts relating to the use of sulphate of potash on Tomatoes. I unhesitatingly declare that no commercial grower of Tomatoes would dream of using sulphate of potash on Tomato plants if he intended to save seed from those plants for his own use. He knows full well that in a few years' time, if artificials of any kind are used, his strain of plants would be worthless.

The Effect of Commercial Fertilizers

What benefits have we derived from the use of commercial fertilizers? Are they time savers? Decidedly not, for any time saved is lost in repeated spraying to combat the diseases brought about by their use. Do they produce heavier yields? Not over a number of years, as compared with crops grown in naturally fertile soil. Do they produce healthy plants? Decidedly not; they are responsible for most of the present-day pests and diseases of Tomatoes. Do they improve the flavour of the fruit? On the contrary, Tomatoes grown with the help of artificials are characterized by their lack of flavour.

A simple test will soon prove my assertions. Grow half a dozen Tomato plants either in pots or boxes filled with compost, particularly using old Tomato stalks and leaves in the heap, and compare them for flavour with any quantity grown with artificials. You will not be disappointed either in weight of crop or flavour. Save your own seed from the half dozen plants and get even better results the following year. They try saving seed from plants fed on artificials. There will be a marked difference in the third season; in fact, with the seed saved from these plants you will have difficulty in raising a stock after three years. If we compare the time spent in preparing compost for Tomatoes with the time saved by using chemical manures and judge the results fairly, we are better able to assess the merits of the two systems. I have tried both and if, by the labour-saving use of artificials, I could produce crops equal to my compost-grown vegetables I would have continued the use of artificials.

Let me give an extract from a book dealing exclusively with artificial manures.

PRODUCE PER ACRE OF TOMATOES UNDER GLASS

	Fruit	*Leaves and Stem*	*Root*
	40 Tons	270,000 lb.	13,500 lb.
Nitrogen	112 lb.	112 lb.	12 lb.
Phosphoric Acid	60 lb.	32 lb.	3½ lb.
Potash	212 lb.	176 lb	16 lb.

ANALYSIS OF 100 LB. OF FERTILE SOIL.

Nitrogen	3 ozs.	—	5,625 lb. per acre.
Phosphoric Acid	1½ ozs.	—	2,200 lb. per acre.
Potash	5 ozs.	—	9,370 lb. per acre.

Surely it will require very little study of the above analysis of fertile soil to convince anyone how very foolish it is to think such soil should ever be in need of a dressing of two or three ounces of sulphate of potash per square yard, when it contains such an abundant supply of this material. The obvious thing to do is to maintain the supply by natural means, that is, from the waste products of the garden and, in particular, all leaves, stems and roots of the Tomato plants which should find a place in every compost heap.

The Advantages of Natural Manuring

If we make our soil fertile by the use of all waste organic material, so that the earthworms and soil bacteria are allowed to increase, they will provide for our plants all the elements needed to produce healthy crops of full flavour. If we supply food for the worms, they will repay us by creating humus regularly year by year in their own way and their own time, but it must be clearly understood that mineral or chemical manures can never become food for earthworms.

There is no short cut to soil fertility. Nature cannot be hurried. If we return to the land the natural products of the land we build up fertility on a sure foundation. If the land is treated with artificial manures, we encourage pests and disease. To control these, more poisonous substances are used in the form of washes and powders, thereby producing the death of the inhabitants of the soil which alone make and maintain soil fertility. There is a safety limit to the weight of crops land can produce. To attempt to gain weight of crop above the normal capacity of the soil by stimulants is sure to lead to a breakdown. The only way to get increased crops is by increasing the fertility of the land, if we wish to avoid any danger of future soil im-

poverishment. There is nothing so grateful as land and nothing so honest.

In the wider sphere of agriculture the usual explanation of the use of artificials is that composting entails too much labour. That excuse does not hold good where a cottager cultivates a garden or allotment. The pitman of Northumberland and Durham, with the finest strains of Leeks in the world, the weaver of Lancashire with his Stocks, and the Rhubarb growers of the Leeds district have for generations maintained the high quality of their plants without the use of chemical manures. Can the users of artificials show similar results? I have watched the decline of gardening in many districts and in the case of cottage gardening it can undoubtedly be traced to the use of chemical manures. The standard of vegetable culture is appreciably lower than it was even thirty years ago. The few outstanding exhibits at the big flower shows represent a very small section of gardening proper, and cannot disguise the decline.

These are my considered views, and the cultural advice given in this book is the result of twenty-five years' work in this county. Many readers will, no doubt, disagree with my methods; I frankly admit I have had disappointments and will go so far as to admit that, although I have grown some very good specimens, I have never yet been completely satisfied with any crop I have yet grown.

Hints For The Victory Gardener

This is the fifteenth of a series of articles by this author dealing with the cultivation of ordinary vegetables.

BY ROGER W. SMITH

CAULIFLOWER AND BROCCOLI

IT is doubtful if any of the fine vegetables you grow are more interesting than the cauliflower-broccoli combination. A clear understanding of the nature of each is essential before any attempt is made to cultivate them.

Briefly, there are two types of broccoli commonly grown today. The first is the large headed cauliflower-broccoli. This is the cauliflower of commerce. The second is the "green-sprouting" or Calabrese broccoli which was quite recently re-introduced. The large headed cauliflower is generally considered difficult to grow, the "green-sprouting" broccoli easy. The latter also owes much of its popularity to the fact that, whilst it produces a smaller head, it has the ability to form many auxiliary heads especially after the main head has been removed.

Perhaps the most marked difference between cauliflower and broccoli is that broccoli will produce edible flower clusters during relatively cool weather whereas cauliflower requires some warmth to form a satisfactory curd. They will grow fairly well under conditions suitable for other members of the cabbage family. However, although green-sprouting broccoli does not form heads as large as white broccoli or cauliflower, the ability of the plant to form this head depends upon climatic conditions. Thus, much of the California cauliflower sold on the market in the Eastern states during the winter months is grown from broccoli seed.

To add to the confusion "broccoli" is the Italian name for turnip and some gardeners grow a strain of seven-topped leaf turnip as "green-sprouting" broccoli. For all that, you know well enough that a large, white-headed cauliflower is one thing, that green-sprouting broccoli is another, after having eaten them both. You will

differentiate when buying seed and secure it from reliable sources only. Cauliflower seed is more expensive than broccoli.

Because green-sprouting broccoli is easy to grow, you will likely start with that kind. Seedlings may be started in a window box in the house about eight weeks before setting out in the garden. They should be transplanted quite early for healthy young broccoli plants will withstand much cold. The seedlings may be set out and handled as with cabbage. If they are set eighteen inches apart in the row a ten cent packet of good seeds will be enough for about one hundred feet of row.

Broccoli seed may also be sown in the open garden at the end of May so that the plants mature their heads during cool autumn weather. Thus you will readily see the wisdom of making two plantings: one by transplants set out about the end of March; the other, by seeds planted late in May.

Some watchfulness is necessary to see that the greenish heads are harvested before the flower buds expand and the curds dry out. After the main head has been cut the side shoots will continue to form smaller heads and provide a steady and heavy harvest over a considerable period. All heads should be cut off in such a manner that a fairly long stub of stem remains on the plant.

With broccoli you will discover few outstanding named varieties other than Italian Green-Sprouting (Calabrese), but cauliflower is available to you in many fine strains most of them of the famous Snowball type.

In the latitude of Philadelphia, cauliflowers are most often grown as a fall crop. Climatic conditions, so important for the proper development of this plant, seem to suit it better at this time. Seed should be sown early in June in a carefully prepared cold frame containing an ample quantity of sifted compost humus, sand, and crushed limestone. The seedlings may be set out early in July. They should be placed two feet apart in the row with the rows three feet apart. One packet of good seed should produce about one hundred and fifty plants.

The head of the cauliflower is not naturally snow white. It is whitened by being blanched whilst it grows. As soon as a head is two to three inches in diameter the outside jacket leaves should be loosely drawn up around it and tied lightly with soft twine. After this stage of its growth is reached the head develops with considerable rapidity reaching its prime in about one week. For this reason you will find it best to test the heads at frequent intervals to see that they do not pass this point before being harvested. Cauliflower plants mature about ninety-five days after the setting out of the plants.

When you consider that the large edible head of the cauliflower, often weighing over two pounds, is actually a huge cluster of flower buds not yet fully grown, you will understand the urgency with which the plant itself requires nutrients in an easily available form before it can even begin to give rise to a flower cluster of such relatively enormous proportions. The plant must have ideal living conditions to reach the extremely vigorous condition necessary for success.

Naturally it is a very rank grower and a heavy feeder. It demands that the soil in which it grows contain an abundance of organic humus, preferably properly composted material, to ensure an ample supply of easily digestable plant food, and sufficient moisture to render plant nutrients available to its roots.

To a lesser extent this is also true of green-sprouting broccoli, for though the edible clusters are smaller their total volume is often very great.

The area in which either cauliflower or broccoli are to be grown should be very carefully prepared some time in advance. While it is true that both cauliflower and broccoli require about the same conditions as cabbage, they are rather more exacting in their requirements. To offset excessive soil acidity and to replace the natural quota of lime, you will find it a simple matter to dig in a heavy application of crushed limestone the fall before the area is to be used.

A little before planting time, a trench some two feet wide and two feet deep should be formed and filled with compost humus. A mixture of well-rotted manure and leaf mold may be substituted if necessary. During the day or two that should elapse to permit the proper settling of the trench, a surface application of hydrated lime may be made if you believe conditions warrant it. This material should be lightly raked into the surface of the soil. If only small amounts of composted material are available, holes one foot in diameter and one foot deep, spaced three feet apart in the row, may be dug and filled with good compost humus. Temporary stakes should be placed to

mark the centers of these fillings.

Many fine methods have been developed in the cultivation of the cauliflower, a vegetable which, with all its difficulties, brings its own reward. It is especially valuable as a late crop following an early one. All these methods depend, primarily, upon the supplying of the necessary plant nutrients through the use of organic humus, the use of lime, and the proper understanding of weather conditions.

Healthy, vigorous young cauliflower plants deserve your respect and your careful handling and treatment. Transplanted in July, they should be allowed to retain as much soil around their roots as possible when they are moved, they should be kept moist and shaded in moving, they should be well watered and well firmed during setting, and in excessively hot, dry weather they should be guarded against wilting by some temporary protection from direct sunlight by inverted baskets, tilted boxes, slats, etc.

If your garden is located in an area known to be very subject to attacks of cabbage root flies, cut worms, etc., it may be advisable to double wrap the stem of each transplant with newspaper so that the lower edge of the wrapper extends well beneath the garden surface after the plant has been set.

Later the plants may be sprinkled with a saturated solution of salt water, or lightly dusted with dry salt, to check cabbage worms, cabbage aphids, etc. However, if ample quantities of organic compost humus have been placed around their roots, the plants will be little affected by insect pests, and if the area in which they grow has been properly prepared, they will be practically free from plant disease.

During the growing period, when light cultivation is generally given to keep down weeds, it is customary to draw a little top soil up around the stem of each plant. Instead of doing this, if you mulch the plants carefully with an inch or so of composted material you will be supplying them with additional plant nutrients at a time when this is most needed to maintain the steady growth so essential to the formation of satisfactory heads. This mulch will also help to retain soil moisture around the roots of the plants and to check the growth of surface weeds.

Neither broccoli or cauliflower are suited for home storage. They are essentially vegetables to be used in the home when freshly cut, yet they can be an important and delightful part of your garden crop.

For the first time in your life, perhaps, you go into the garden in search of a couple of heads of cauliflower of your own growing. You have many misgivings. Much of the brightness of the garden foliage has been wiped away by autumn cold. You select and cut with your pocketknife a couple of large heads that look promising, sever the twine and trim away a few of the jacket leaves. You are suddenly confronted by a large, snow-white cauliflower. You hurry with it into the house feeling amply repaid for all the hard work you did during a whole season in the garden.

Earthworms in Revolutionary Days

"Earthworms, though in appearance a small and despicable link in the chain of nature, yet, if lost, would make a lamentable chasm. . . Worms seem to be the great promoters of vegetation, which would proceed but lamely without them, by boring, perforating, and loosening the soil, and rendering it previous to rains and the fibres of plants, by drawing straws and stalks of all kinds into it; and, most of all, by throwing up such infinite numbers of lumps of earth. . . Worms probably provide new soils for hills and slopes where the rain washes the earth away. . . The earth without worms would soon become cold, hard-bound, and void of fermentation; and consequently sterile."—Gilbert White, 1777.

Friends in Need

If ladybugs and lacewing flies visit your garden, you are lucky, for they destroy destructive plant lice without harming the plants.

Wiser Than Some Humans

Sir,—I thought you might be interested to know that the 'possums eat our compost-grown silver beet and leave the neighbours' stuff alone.—Mrs. C.W.C., Inglewood. — *Compost Club Magazine* (New Zealand).

With Sir Albert Howard

July 30, 1943.

Dear Sir Albert:

One of our readers has trouble with ants in the compost heap. Can you suggest anything?

Sincerely,
J. I. Rodale.

14th September, 1943.

Dear Mr. Rodale:

In reply to your letter of July 30th, the only information I have about the work of ants refers to termites, the ants of hot countries. These live on organic matter, leave residues very much like the earthworm does, and make plenty of tunnels for aeration. I think the ants of temperate regions act very much in the same way.

If your correspondent had an ants' nest in his compost heap, it rather shows that the fermentation did not go quite according to plan and that the ants came in to complete what the fungi and bacteria ought to have done.

Yours sincerely,
A. Howard.

October 4, 1943.

Dear Sir Albert:

Enclosed herewith is a letter which I sent to one of our readers, who seems to find it difficult to get sufficient earth for use in the compost heaps. What is your opinion as to the use of old compost from previous heaps in the new heap, as suggested?

Sincerely yours,
J. I. Rodale, Editor.

Dec. 8, 1943.

Dear Mr. Rodale:

Your letter of October 4th and your reply to Mr. Kuhl. I think your suggestions are excellent. A great deal of earth can be obtained by cleaning out ditches. As you say in your letter the amount of earth needed for compost is not very great. It is valuable of course in providing bacteria and also as a base for neutralising acidity. The progress you refer to of bedding down your steers by constantly adding fresh straw has been practiced in this country for many years. We call it "covered yard system." At the end of the season the manure under the animals is 6 feet deep and has to be removed with the help of a cutting knife, such as is used in hay-stacks. Personally I have never found any shortage of soil in composting. I took every care to collect earth which finds its way into ditches.

Sincerely yours,
A. Howard.

Oct. 11, 1943.

Dear Sir Albert:

One of our readers from Los Angeles, California has a problem of dealing with soil that is strongly Alkali. Is there any information you can give as to the best method to restore its fertility. I believe this trouble is confined only to sections which have tropical climates.

Sincerely,
J. I. Rodale.

Your letter of October 11*th.* The best reply you can send your reader of Los Angeles is to give him a copy of the enclosed article which appeared in "Indian Farming" in 1940 by Col. Sir Edward Cole. You will see that Sir Edward deals with alkali soils in a very interesting way. He scrapes off the alkali soil from the surface, grows grass on the alkali patches and follows this up by a dressing of compost. Sir Edward is now making about 8,000 tons of compost on his estate which has been growing from strength to strength. I think Mr. Fisher will find it much better to adopt the operations on the lines of Sir Edward by removing the alkali and then increasing the humus and the bacteria. My experience in dealing with alkali soils in India showed that, once alkali salts are removed, this soil becomes extremely fertile and remains so, provided of course the management is correct.

Salt Lands Reclaimed By Dhup Grass

Reprinted From Indian Farming (June 1940)

BY COL. SIR EDWARD COLE

The Coleyana Estate, Okara, Montgomery District.

LARGE sums of money have been and are being spent in India in reclamation of kallar lands, and it may interest some to hear how I have reclaimed many acres at Coleyana and how these lands are now some of the most productive in my estate.

I am not a scientist, but I

know my land. As I understand it, kallar lands, in addition to containing an excess of salts, are deficient in humus and possibly in bacteria useful to plant life and therefore to improve such land both have to be supplied. When I cut a watercourse across kallar land, the first plant I noticed growing on that water-course was dhup grass (Cynodon dactylon) and that made me think. Gradually I evolved the following practice which has been most successful here and has enabled me to reclaim well over a hundred acres of bad kallar for which I could get no tenants.

How it is done.

I scrape all visible kallar from the land on to the irrigation butt—kallar must never be ploughed into the land. I then water and plough with the country plough. Old tough dhup grass is chopped up into lengths of one inch and a half and scattered thickly over the land. The land must be well covered. Then a sohaga or leveller is passed over the land to level the plough furrows and press in the grass. Give manure if you have it, another watering as soon as you can, and leave it. In about six weeks' time you will see the grass has set and begun to grow. If any kallar appears, scrape it off again on to the butts and put down more chopped grass on the site. When grass has started to grow, give another watering and then leave it, the less water given the better because you want to drive the roots down to open up the soil. In the first year after the grass has rooted, one watering in 8 or 10 weeks is sufficient, after that one watering every four months.

I used to think that a legume sown in the grass after the first year was an advantage. I am now inclined to favour the grass alone because if you put in a legume you have to water and the less water the grass has the deeper its roots will go, and one requires to get the grass roots deep down to open the land and give it humus and bacteria. Grass should be grazed by sheep or cattle.

Points to remember

After grass has been down for three years, I start to kill the grass. Plough with a turnover plough, pressing the inverted grass down into the soil and allow the sun to kill the roots: no water on any account to be given. I allow the land to lie fallow during the hot weather and then prepare for a rabi crop, wheat or oats. Never put in a kharif crop after grass as all the grass will come up again. I take two cereal crops off such grassland and then put it into lucerne or cotton. My experience here is that land treated thus is now sweet land and goes into the ordinary rotation.

A point to remember is that before the grass is turned in all kallar that remains on the butts must be carefully removed off the field. It must never be ploughed in.

I also use this method with very stiff clay lands and find it most useful. The grass opens up the soil and the rotting turf improves the tilth.

On my lands I find that pouring large quantities of water on the land and growing rice leaves me with a hard set land with litle humus and difficult to work, whereas with the help of dhup grass I produce a grazing ground for cattle and sheep. The land becomes full of humus and by the cheapest and quickest method I obtain land easy to work which is free of kallar. The results can be seen at Coleyana.

Soap in Treatmemt of Ivy Poisoning and Hay Fever

THE serious loss in man-hours caused by workers suffering from hay fever and ivy poisoning will make this unusual application of soap interesting to everyone connected with industry and war production. It has been reported that twelve hay fever patients were cured of their symptoms by spraying nasally and dropping into the eyes a simple solution of sodium oleate soap dissolved in 10,000 parts of water. A momentary smarting feeling is produced, but two treatments a day is said to have resulted in definite improvement within four days in even the most severe cases.

A 10% solution of sodium oleate in water, applied as a dressing, is also said to be very effective for acute ivy poisoning. For the same purpose, a 10% mixture in lanolin makes a good ointment.—*Rose Technic.*

The Good Earth

Reprinted from The Medical Press and Circular (England)

A Magazine Published for Physicians

TODAY, for the first time in our history (and we believe, for the first time in the history of any medical journal,) we publish an article by a farmer on what might appear to be a purely farming problem. But it is, in fact, a problem that raises the most fundamental issues with which we deal. We make no apology for this departure; on the contrary we can only express surprise that we should still have to regard it as an innovation. For if there is one goal on which the eyes of our profession are set to-day, it is health, and the first and indispensable condition of health is that it must be based on adequate nutrition. In common with all other forms of life on land, we depend for our existence on the fruitful interaction of sun and soil, and we are bound up in an inescapable symbiosis that comprehends the humblest of soil bacteria and the proudest of living mammals. The farmer's work is, in fact, an essential prerequisite of our own.

Soil health, with which our contributor deals, is apt to be taken for granted by the uninstructed. In truth, this assumption is one of the most dangerous that we could make, as history so painfully records. Consider, for instance, the famous river civilisations of Mesopotamia, whose ruins are now submerged in the sinister and unbroken desert; consider Libya, arid and evil with its sandstorms, once the fabulous granary of the Roman Empire. Consider the dustbowls of modern America that have developed with such appalling rapidity within the last few decades. And lastly, let us consider what has been happening in our own country in recent years.

But first to examine an apparent paradox. It is beyond question true that the public health has enormously improved during the past hundred years. Sanitation and epidemiology have made tremendous strides. The advance in surgery since the discovery of general anæsthesia, and of both medicine and surgery since the epochal discoveries of Pasteur, has been phenomenal. Many of the Captains of the forces of Death have been subdued or vanquished. We have our asepsis, our vaccines, our sera, our X-rays and insulin, our penicillin and sulphonamides, all of them great and literally vital advances. We have stamped out or brought under control many sources of danger, and we have prolonged human life by a decade or more.

But is that the full story? As Lord Teviot pointed out recently, in a most revealing debate in the House of Lords, side by side with all this achievement has marched an increasing array of minor, though often crippling, disorders, amounting in the aggregate to an enormous total. Millions of money represented by the work of hundreds of thousands of doctors, nurses, technicians and chemists are constantly engaged in grappling with this problem. Hundreds of thousands of hospital beds have to be provided and maintained—indeed, if we include the employees of drug manufacturers, the personnel of the retail chemists' shops, the health workers and visitors, and other public health employees, the clerical staff of hospitals, the porters and wardmaids, the ambulance drivers, and so on, we must compute an army, engaged in this conflict, many times the size of that mobilised to repel the Spanish Armada!

How is all this to be changed, if it can be changed at all? This is no easy question to answer, but we may say, in general, that there are two main lines of attack—by pressing forward with preventive medicine, and by pursuing the quest of "positive health." And, of all the factors that go to constitute the

latter, diet, as we have stressed already, is the dominant one; perhaps, too, it may play a larger rôle in the former than we now suspect. Diet, that is, meaning not only the type and quantity of the food we eat, but its essential quality — a question that our investigators take, far too often, for granted.

About one hundred years ago the great German chemist, Liebig, laid the foundations of a process that has since had an immense effect on the agricultural practice of Europe and America. This was the stimulation of plant growth by the application of chemicals to the soil. This method spread more and more widely until to-day it may be said to be universal in the West. This chemical treatment of our soil seemed at first to do nothing but good, particularly when only used in an auxiliary rôle. Yields were greatly increased as the technique of application was improved. But in later years, since it has become more and more the method of choice, other factors have thrust themselves on the notice of our agriculturalists. Disease, both of plants and animals, has greatly increased, and more and more pressure has had to be applied to the soil to maintain its yield. Recently, diseases of stock have assumed alarming proportions, and the very existence of our dairy herds seems to be threatened by one of them, contagious abortion, alone.

The conviction that something is very wrong has grown more and more irresistible, and recent years have seen new researchers taking the field, of whom Sir Albert Howard is the chief apostle and protagonist. He believes that nature's cycle must be restored if the soil, and the animals that derive from it, are to regain health. That cycle may be epitomised by saying that all that comes from the soil must go back to it—vegetable waste and animal excretion alike. By special treatment (composting) of these wastes humus is made. Unlike many chemicals, humus does not depress, but stimulates the biological flora of the soil, and especially those fungi—the mycorrhiza—that seem to bridge the gap between soil and rootlet, and whose presence in increasing numbers gives a mounting index of health. Humus, too, it is believed, holds much of the moisture of the soil, preventing alike soil dropsy or dehydration. By means of composted humus, Howard and his co-workers not only claim to restore vigour to the soil, but produce plants of vastly improved quality and flavour that are, moreover, *resistant to disease.*

From our point of view this last is a crucial point. If Howard's claim be well founded—and there is much evidence that it is—then by the restoration of its natural pabulum plant resistance can be greatly exalted. If chemically nourished plants be defective in certain vital resistance-conferring factors, then it is but natural to assume that animals fed on such plants will similarly lack resistance, and that human life, parasitic on both plant and animal, will share the same defect. Conversely, human life nourished on the products of a healthy soil should exhibit greatly exalted resistance.

What evidence is there of this? Again, much that is suggestive, but we must beware of arguing too much by analogy. There are many factors to consider. But apart from McCarrison's classic and, one might add, conclusive experiments, to which Lord Teviot referred in the debate in the Lords, there are many striking phenomena which one cannot overlook. The diet, for example, and the enormous disparity in physique and sickness-rates between the Northern Indians—Sikhs, Pathans and Hunzas—and the peoples of the South. Or the Prince Edward Islanders described by Lord Geddes, in his acutely analytical address in the same debate, as "an extraordinarily vigorous and active population, and quite remarkably the only social organisation composed of Western Europeans, which has not shown in the last fifty years a really sharp fall in the birth-rate." These islanders lack cities; they carry on mixed farming "using muck and the products of the sea."

Vigour, fertility and resistance. These are the qualities we seek. Are they to be ensured dietetically? What has modern dietetic research to say? So far, one must admit, very little. Piecemeal research on this or that vitamin complex goes forward, and here and there one or other fragment of the mosaic of knowledge falls into place, mostly from the chemical viewpoint. But the great design still by much eludes us. That is surely because it consists of a fusion of pictures superimposed one on the other. There is a physical picture of the world and a chemical picture of the world, but there are also ecological and biological pictures of the world, and these, for our present purposes, represent the final and dominant synthesis. To base our nutritional policy on our present rudimentary—and mostly chemical—knowledge of dietetics, and in par-

ticular, to denature foods, and to claim to restore them by the addition of a few laboratory-made vitamins, has always seemed to us an example of *hubris* that may yet be fittingly chastised. Lord Teviot's friend, we are told, preferred to take his vitamins with his knife and fork and spoon; we can only add that he has our sympathy. It would be a simple matter, one imagines, to break up and analyse a battery and fail to discover the electricity—suppose one to be ignorant of its existence. The analogy need not be pressed.

For our part we hasten to associate ourselves with Lord Teviot's demand for a Royal Commission to enquire exhaustively into the whole matter, and we call on the new Ministers of Food and Health to lend their support. In this purse-proud capitalistic age, soil fertility is our own true capital, and soil health the only sure and lasting prop of public health in its widest and truest sense. We place the issue before our readers, not for the first time, to stimulate their interest and enlist their support. They will hear more of it; we can be sure of that. For whatever way we look at it, health begins in the soil.

Vegetables Without Vitality

GARDENERS commonly think of plant vitality—the ability of the plant to reproduce its kind—as an elusive, obscure, and unimportant quality. But if you will consider the matter for a moment you will realize that barrenness of seed, the inability of a given strain to survive, is a very serious thing; that lack of vitality in much of the vegetable material now used for human consumption may have little suspected but grave and far reaching effects.

You can easily make a simple test of the ill effects artificials have upon plant fertility by growing a few tomato plants in large pots filled with a mixture of sand and poor topsoil and grown solely through the use of artificials and water. To be fair, the pots should be located where they have their share of sunshine and air, but they should be kept free from all contact with natural humus. Later you can compare these plants with those grown in rich compost humus.

Later you will consider your experiment. What were the results of such a test upon vitality? You find that at the end of the first season the plants grown with artificials bore tomatoes. True enough, these tomatoes were of poor flavor, but they were there. But if you save the seed from these forced tomatoes and use it for the production of seedlings the results will be most enlightening. By the third season the number of seedlings and their quality will be decidedly bad. Each season the seed saved from the forced plants will produce fewer seedlings, so that by the fourth season almost all the seed saved will fail to germinate. The vitality of the forced plants has "run out" in spite of the fact that healthy tomatoes produce a large number of seeds. If you made similar tests upon seed-bearing food plants, the results would be even more enlightening.

But before going into the question of what effect the consumption of vitality-lacking vegetables has upon health, you look again at plant vitality. Just what constitutes plant vitality?

You recall that highly forced, prized strains of hot house roses "run out" in a few years. That the more the strain is forced into growth by the use of chemicals the quicker it "runs out". You recall, also, that the wild roses still drape their flowers over hedgerow and hillside as they have done since time immemorial. The truth then is clear. The hot house strains became exhausted because of the artificiality of their conditions and more especially their diet, while the wild roses thrive because they subsist upon the plant nutrients supplied by Nature's compost.

You return to the tomato seed test and decide that there seems to be little doubt that the seed which lacks viability —the ability to germinate and grow—and which is produced by a plant of exceedingly low vital power must also be lacking in its normal quota of healthgiving substances, termed for convenience hormones and vitamins.

For very obvious reasons it is most difficult to learn the results of scientific tests which

show lack of food value in the forced vegetables which fill the market. Inadvertently, dieticians have clearly demonstrated that forced carrots may contain much less than fifty per cent of their normal quota of food value because this fact has given them much concern.

But it seems likely that, by the use of artificials much market vegetables, roots and seeds, are almost entirely lacking in their natural complement of healthgiving substances for these are very subtle and undefined.

The immediate effect the consumption of large quantities of this vitality-lacking vegetation has upon our national health is apparent to you by the frequency of dietary deficient ailments. You find that the dreaded "scurvy" still exists in the larger cities, pellagra in the rural areas in the South. But what of the long range effect of such seriously deficient vegetation when used as a diet?

You wonder how much of the grain that feeds our people is robbed of its natural vitality by the use of the millions of dollars worth of artificials which are used in its growth. If, by the use of artificials, plants may be caused to produce seed without the power to germinate, as you have demonstrated, there seems little doubt that this kind of material has little or no food value. And if the grains we use as staples are forced by the use of artificials, then it seems clear that they too have little food value.

This is even more important when you realize that cereals and some green vegetables together provide a very large proportion of our essential supply of what is called today Vitamin E. Science has shown, as you know, that various small animals fed a diet deficient in this vital substance become impotent, without vitality, and quite unable to reproduce their kind.

Under the circumstances, could it be that the partial deficiency now existing in the grains and vegetables without vitality so much in use could result in a gradual and insidious slowing down of the vital powers of that great mass of our people unfortunate enough to be obliged to subsist upon it—a partial impotence unnoticed now but increasingly apparent with the second and third generation?

This may bring you back to something you wondered over long ago. You recall that much of the huge quantity of roots and seeds and plants grown for the market by the use of artificials were not recommended by honest seedsmen for planting purposes. Various explanations were given.

Whatever the explanations were, they caused you to view with greater regard your own humble garden. You dug it yourself, enriched it with well-ripened material from your own compost heap. Late in the afternoon, the vegetation is aglow with sunlight, rich in natural health. The observation of it brings to you a somber thought.

You have recently heard that many of the great factories now engaged in the worthwhile production of chemicals for war have very definite plans for the peacetime *production of poisonous chemicals to be used by agriculture.* When this avalanche of chemicals is turned loose upon the farms and gardens of our land, what will be the end result upon our national health?

If you are able to detect the ills of this system apparent around you now, what of the health of future generations? Will those who might have been the virile young Americans of the future, for whom we struggled so much, become a truly terrible indictment of the unnatural production of deceptive vegetables without vitality? Or will they, too, stand in the late afternoon sunshine, in their own organic gardens, understanding the essential food value of normal vegetables grown Nature's way—by the use of fertile soil and healthgiving compost humus?

Will they, perhaps better than we, avoid the very grave dangers that vegetables without vitality present to our national health?—R.W.S.

Are Chemicals Needed?

"Obviously a fertile soil has no need of chemicals. But examples without end are needed to drive this point home and to expose an impudent device to persuade the public to spend their money in the hope of increasing crops beyond the natural limits set by Nature."—Sir Albert Howard.

Animal Feeding

Extract from a letter dated April 23rd, 1942, from the Rev. Willis Feast, Booton, Norwich.

One young farmer told me that he grew swedes, some with and some without artificials.

He fed the "withouts" first, and when they were finished had the greatest difficulty in persuading his beasts to start eating the "withs."

Earthworms in an Orange Grove

From THE VALLEY NEWS (Montrose, California)

NEAR Redlands, California, is an orange grove that people come miles to observe. It demonstrates a unique natural method of orchard culture.

This 40 year old grove stands out among its neighbors in a way that even a layman can see. The foliage is thicker, a richer green, even at the top where others of its age show thin foliage and bare twigs. The trees are well filled with fruit and records show that they produce crops just as outstanding as their appearance. But the truly remarkable thing about this grove is the fact that these results are obtained with less labor, less water, and less fertilizer than is used by any of the neighbors.

The present owner took possession 17 years ago. Since that date, no plow, harrow or cultivator of any kind has been allowed in the grove. Weeds have been eliminated by hand labor. At first this caused extra expense; but since no weed is allowed to go to seed, a few hours labor once a month is now all that is needed.

The absence of mechanical cultivation is the first puzzle which this grove presents to horticulturists, for the necessity of soil conditioning has long been recognized. Actually this need has not been ignored here, but the owner depends, not on machinery, but on the world's finest and most efficient plow, the lowly earthworm. He has created conditions which are favorable to earthworms and in response they have multiplied until they are more numerous than in other groves. Their network of burrows has aerated the soil far more effectively and much deeper than mere surface cultivation could hope to do. At the same time, the feeder rootlets, which in an orange tree are very near the surface, are left undamaged, and therefore ready to absorb a maximum of food.

Even more puzzling to the orthodox grower is the fact that this grove thrives on less than 50 per cent of the water required by others. The answer once more is explained by the burrowing habits of the earthworms. They prefer the cooler soil under the trees and dig most of their burrows there, with very few out in the sunny spots. During irrigation, a large proportion of the water enters the soil through these burrows, with the result that most of it goes under the trees where the roots can use it, while much less than usual is wasted out beyond the root zone.

But the fact about the grove which seems hardest of all to comprehend is its fine health in spite of what seems to be a very inadequate fertilization plan:—a little synthetic nitrate occasionally, nothing else in 17 years. Once again the earthworms furnish the answer, this time by their digestive processes. Earthworms depend for food on dead organic matter, leaves, old roots, etc. Through digestion these substances are changed in character so that they are highly soluble and when ejected are immediately available as plant food. A close examination of litter under the trees reveals thousands of leaves which have been completely consumed except for a delicate skeleton composed of their veins. The worms have put this material back into the soil, for re-use by the trees. Without them, it would be a very long time before the same material would become available for plant food.

The earthworm's gizzard triturates large quantities of soil which the earthworm takes into its body for two purposes—one to make his burrow by eating his way in; the other to obtain from his food all the essential elements necessary to produce fertile eggs.

New surfaces are thus exposed to the dissolving action of the irrigating water, and plant food elements are released which would otherwise remain locked up inside the grains of soil. Couple this with the fact that earthworms work to a depth of 6 or 8 feet, constantly bringing new dirt from these levels to the surface, and it can easily be understood how trees can thrive for a long period without the addition of new feed elements to the soil.

Earthworms are nature's own means of soil building and conditioning. No orchard or garden can do its best without them. There are many kinds, some much more effective than others, and the study of their use and culture will repay anyone who grows fruit and flowers.

Rothamsted Agricultural Station

Reprinted from Cavalcade (England)

YOUR note on Rothamsted (*Cavalcade*, July 31) says that the station is supported by the Government. This is misleading. The Ministry of Agriculture makes a grant admittedly, but if you consult the annual report you will find that considerable sums are received from The Fertilizer Manufacturers' Association, The United Potash Co., Imperial Chemical Industries, The Association of British Chemical Manufacturers, British Basic Slag Companies, etc.

Agricultural research in Britain is largely supported by, and its direction controlled by, the Chemical Combine. Extremely valuable work has been done at Rothamsted, but it has always been largely concerned with methods of using chemical manures. The rich soil at Harpenden, which can grow straw crops for a hundred years without soil treatment, has been used for experiments in growing crops with artificials, and the misleading conclusions have, as you say, formed "the basis of much modern practice" which has unfortunately led to vast tracts of the earth's surface being turned into desert by mechanised chemical farming.

Agricultural research in this country is concerned mainly with devising methods of using chemical manures so that their long-term destructive effects are not immediately apparent and in devising new sprays, dusts, etc., to wage the everlasting fight against constantly increasing pests and diseases which inevitably follow wrong methods of husbandry.

Sir Albert Howard had the unique opportunity in India of carrying out a lifetime of research with public funds and no interference from vested interests. His conclusion was that chemical manures are anathema. Sir Albert has shown that animals fed on food grown with chemical manures are disease-ridden, while comparable animals on the same diet grown on soil treated with organic manure are healthy. Such vital research gets no publicity and the food we eat is mostly grown with artificials. (In war-time quantity must come before quality, and the rape of the soil with chemicals can be excused as a short-term policy.)

Remember that the Chemical Combine is interested not only in the sales of fertilisers, but the sprays, drenches, drugs, and serums needed to counter the ultimate effects in plants, animals, and man.

We have heard much else lately about the Chemical Combine and its "War on the People", but this aspect, the influence on methods of agriculture, is of primary importance since the survival of man on earth depends on it.

S. NEEDHAM.
Carshalton Beeches, Surrey.

EDITOR'S NOTE—Rothamsted Agricultural Experiment Station of England was the first station started in the world.

Deterioration in Vegetables

THE writer has observed for some years a gradual deterioration in the flavour and quality of fruit and vegetables, until today most of what we buy is defective or diseased. Even so common a vegetable as the pumpkin goes mouldy after it has been cut for a day or two; it is also "woody". A really sweet pumpkin is a cherished memory. Potatoes have reached the stage where it is difficult to peel them when cooked in their skins.

This state of affairs in an agricultural country, with such a small population as ours is incredible.

The Society is optimistic with regard to rectifying at least in some measure, the evils of our present agricultural methods. An initial start has been made with a dairy farmer in whose district black beetles eat out maize particularly, and all other crops including the grasses and potatoes in their young stages of growth. One interesting feature was that out of 100 cabbage plants, the beetles left three. These latter had old milk can tops placed around them. It would appear that the metal in these tops had some radiative effect which kept the beetles away. — Excerpt from letter to Sir Albert Howard. From E. Jeremy, Secretary of the Australian Compost Society.

Penicillium Found in Compost Heap

BY ROGER W. SMITH

A spot of mold on a microscope slide. A scientist's curiosity about the ability of the mold to destroy the deadly bacteria the slide contained. And modern science met *penicillium notatum*, one of the microfungi so plentiful in the compost heap. Progress follows strange paths indeed.

Today a battery of scientists are doing organic gardening in test tubes as the chemistry of natural products delves into the growth mysteries of the microscopic fungi associated with organic humus. With scrupulous care they are planting and growing the same humble organism which is produced by the countless billion in the compost heap. For they have discovered that this tiny organism is capable of forming a metabolic product which is antagonistic to pathogenic (harmful) organisms though nontoxic to man even when taken in very large doses. Chalk that one up for the little fungi that multiply so happily in the well-made compost heap.

Such intensive study of this micro-organism can but bring new respect for the principles of organic gardening. Much new light will be shed on just what happens during composting, just what conditions are favorable for the rapid development of *p. notatum* and related organisms.

The recent interest in soil organisms follows a long period of scientific speculation. It was apparent that through the ages incredibly vast quantities of disease producing bacteria must have been introduced into the soil, yet it is a well established fact that with very few exceptions organisms pathogenic to man and beast do not remain alive in the soil for very long. What strange microscopic creature destroyed them so rapidly? Today, interest centers around the terrific power of the homely little fungus *p. notatum*.

No doubt other tiny fungi with which *p. notatum* is intimately associated will receive the same deliberate examination. Several strains of *p. notatum* have already been identified each having varying power over harmful bacteria. What strange and valuable information will be available when the other micro-fungi, *Alternaria, Mucor, Cladosporium, Rhizopus, Zyngorrhynchus, Aspergillus, Trichoderma,* and *Helminthosporium* get the spot light?

Organic gardeners will be waiting the answers to innumerable questions of practical value. They know, for example, that the layers of topsoil spread through the compost heap collect and hold ammonia produced through the activities of micro-organisms but to what extent does this same topsoil serve to inoculate the heap? There are literally hundreds of questions.

Already, in the laboratory culture of *p. notatum* by mycological chemists much has been discovered. For one thing they have come to understand its instability, its great sensitiveness to infinitely minute changes in its surroundings.

It is interesting to see these laboratory gardeners at work. First a sample of the fungi is studied until it reaches the spore stage. Then the spores are gathered into sterile sand and the mixture dried and held in refrigeration for use as needed. A minute quantity of this spore-sand is all that is needed for one culture. This amount is placed in a thin layer on the surface of solidified agar held in a sterile container. After a period of from four to six days it grows and produces a crop of grass-green spores. These are transplanted to a nutrient broth—culture media made of sterile beef extract and distilled water. In from seven to fourteen days the spores, which float on the surface, germinate and become visible to the naked eye as cottony-white surface patches eventually creating a distinct layer. A few days later, the slender stalks of the fungi may be observed through the

microscope to develop their several branches each bearing grass-green spores. During the entire process infinite care must be taken to guard against the intrusion of unwanted air borne spores.

Thus the scientist cultivates in his test tubes the little fungi of the compost heap.

P. notatum has been found especially sensitive to any change in the pH (hydrogen-ion concentration) of the media in which it grows. And in spite of the very urgent demand for a vastly increased production of this micro-fungi it seems that so far no attempts have been made to inject artificial fertilizers into the culture media. One can only imagine the disastrous effect of such an attempt.

Mycologists do not recommend the addition of superphosphates to the culture media, either. However, it has been found that the pH must be properly regulated and controlled for proper growth—the equivalent of applying lime to sour soil.

Organic gardeners will watch with interest the outcome of the work involved in the culture and examination of *p. notatum*. They will find it pleasing to reflect that an obscure worker in the compost heap has come into prominence, that it is now titled "the newest microbial antibacterial agent", that in war time it has become a powerful healer of wounds and saver of human lives.

That, for a micro-fungi whose most colorful role has hitherto been that of breaking down organic matter to produce fine compost humus, is quite a record. Organic gardeners will sincerely hope that others of its micro-fungi associates of the compost heap will do as well.

Soil-Less Foodstuffs for Experts Only

Frauds and Answers Magazine (La Crescenta, Calif.)

Chemiculture, the method of growing crops without soil by means of nutrient solutions in water is still in the experimental stage and amateur and home growers will find soil-less vegetable culture is not practical.

This statement made by the Department of Agriculture should deter a great many Victory gardeners from wasting money.

In a recent case against the Federal Victory Garden Research Institute, Nashville, Tenn., the FCT called in the U. S. Agricultural experts who proved by experiments of their own that only through the use of special equipment by chemists, physiologists and trained technicians, could soil-less or chemiculture be successful.

The boys in Nashville were opportunists. The tremendous national drive for Victory gardens almost proved to be a windfall for the alert promoters. So posing as chemiculture experts they advertised far and wide via press and radio their pamphlet, "Introduction to Chemiculture," which explained that the inexperienced Victory gardener could grow an ample supply of vitamin laden vegetables in his attic, basement, garage or any available space. Of course, the wide publicity of a few years ago gave impetus to the Institute's campaign.

The necessary equipment and chemicals for chemiculture or hydroponics is difficult to obtain now, because of priorities, in addition to the need of skill and experience.

When the FCT completed its hearings the Southern gentlemen agreed that their claims were about as impossible as it is to grow foodstuffs from magic dragon seeds. So, Herbert W. Knopp and Edgar W. Mong, the owners of the Federal Victory G. R. I. who had posed as chemiculture experts after reading a few books on the subject in the Nashville library, are now engaged in other lines of endeavor. Maybe the boys can research the libraries and discover a long forgotten secret method of growing your own meat.

Reader's Correspondence

Gentlemen:

I am one of your ardent converts to organic gardening, and in the course of reading your magazine for the past year have pondered over the following questions:

1. What is the essential difference between organic gardening as you advocate it and bio-dynamic gardening as advocated by Dr. Ehrenfried Pfeiffer, outside of the use of his preparations 500 to 508 which are purely of animal and plant origin?

2. Our wood ashes in the fire place are mixed with a large percentage of paper ashes. What is the effect of paper ashes on the humus pile? Do they contain any potash as wood ashes do, or are they harmful like coal ashes?

3. In order that our humus pile which has more leaves and vegetable waste in it than animal matter be not lacking in phosphorus, we add bone meal. What can we put in the pile to supply potash for our root crops besides our very meagre supply of wood ashes?

4. Our asparagus bed occupies a spot which we want to use for something else. The only place we can transplant it to is shaded from the morning sun by a garage on the east side. There are also trees on the north side. Will the asparagus bed do well here with plenty of humus? If not what vegetables will grow well under these conditions of partial shade?

Jean Enzenbacher,
Longmeadow, Mass.

Answer

Dear Miss Enzenbacher:

Replying to your letter of January 10th:

1. The bio-dynamic method recommends the making of a compost heap using manure separately in heaps and also using green matter alone exclusively in other heaps. They do not follow Sir Albert Howard's Indore process.

We have heard from people who have used the bio-dynamic method and they spoke very highly of the results obtained. At the present we are following Sir Albert Howard's methods on our farms, but in later years when the labor situation rights itself, we will experiment with the bio-dynamic method.

2. We would not recommend the use of much paper or paper ashes in the compost heap. They would contain some potash because they originate from green matter.

3. The main source of potash is green matter. All plants contain potash so that if as you say, you have used plenty of green matter, you are well taken care of for your potash.

4. Asparagus should be in a sunny location. They should also be at least four feet away from other permanent plants such as artichokes, rhubarb and strawberries and still farther away from trees. Plants that like shade are described below.

Lettuce: Lettuce is a cool weather crop and will thrive in partial shade.

Garden Peas: Will thrive in partial shade.

Cucumbers: Require a cool, moist, even slightly shaded location.

Kohl-Rabi: Well drained, not overly exposed to excessive sunlight.

Scallions: Will tolerate a slight amount of shade but prefer open, moist, sunny conditions.

Mint: Will grow, if much moisture and a little shade is available, even on lawns.

Dear Sirs:

I have been intending to write and comment on some of the recent articles in the Organic Gardening but since my husband and I between us are doing all the work on our farm and taking care of around fifty head of cattle in addition to chickens and sheep, I don't have much time for letters.

Going back to the articles by Mrs. Balfour in the October issue, she refers to white scours with her pigs and correcting it by feeding them the fresh soil. When we first came up here and had trouble with scours in calves, we were told to go out and get a piece of sod from some clean ground and bring it in for the calves to eat. It sounded sort of silly but we tried it and it was successful. Since then we have always kept sod in front of our heifers in the winter and we never have any trouble any more.

In answer to Mr. Carol Brown's letter in the same issue, we had more or less the same problem when we first moved here. Our pasture, which at some time had been cultivated fields, had grown up

pretty well to hardhack and thistles. It was badly washed in some places. We have pastured it much more closely than good pasture management calls for. We have been here five years and now have a fine sod of clover and fine grasses. We did not resow this land but did lime it. The cattle have done the rest. We have fed them supplementary feed while on the pasture so that the manure has returned rather more than has been taken off. They have eaten or broken off the hardhack and other weeds and the grass and clover have come in in their places. I certainly wouldn't plow the hillside. If Mr. Brown wanted to reseed, I would suggest that he disk it, preferably with a tractor disk and reseed on that land. Another way is to sow the seed on the last snow in the spring and that way you will get very good germination.

I enjoy Organic Gardening very much but don't see how, with the help situation what it is, it is possible to apply it now. In addition to that with our situation, I don't know where we would ever get the organic material to compost without manure. We have well over a hundred tons by spring. Of course we use sawdust as bedding and that is mixed with the manure. I suppose that could take the place of some of the organic material but it wouldn't be put in in layers. And without any help but my husband and myself, we find it impossible to handle that amount of material. We have to hire someone extra to get it out in the spring and it goes directly on the fields then. We have no cover under which to store it during the winter and it is frozen solid for most of the time before it is spread. It is just at the top of our pasture so that any that leaches out of the pile, runs down onto the pasture and the grass there certainly does grow.

E. T. Latting,
Andover, N. H.

Answer

Dear Mrs. Latting:

While we favor plowing under many conditions, we would certainly go easy on hillsides and would definitely make an exception in such cases. The government suggests that where one has to plow hillsides, it should be done on the contour so that water cannot run down the hill.

You are quite right about the war-time help shortage. In many cases it is impossible to change over to the Organic method exclusively on farms because of this, but in all cases an attempt should be made to place part of the acreage on an organic basis and gradually change over completely when the war is over.

We can assure you that there is sufficient available organic material. In your case you state that you have 100 tons a year. For the size of your farm you would need at least 200 tons. Sawdust will break down in the compost heap, but what you need is plenty of green material to be included with your manure. In that way you increase your fertilizer by 200%.

After exhausting every other means of obtaining organic material, you might plant special hay crops on fields that you are fallowing and allow part of it to be turned under and the rest of it to be taken off with the proper equipment and placed in the compost heaps. You will find that in the long run your farm will be more fertile if you do fallow a small portion of it each year and in fallowing, you can have a crop such as red clover with other hay mixtures included and leave such field in such a condition for about two years.

Please bear in mind also that where you farm with chemical fertilizers, it costs money to buy these fertilizers. Why not take that amount and purchase from your local fertilizer dealer, organic types of fertilizers, such as bonemeal, tankage and other organic materials that he might have.

You might also purchase some ground phosphate rock. The Ruhm Phosphate and Chemical Co., of Mt. Pleasant, Tennessee, mine the raw phosphate rock which they grind up. This is a non-corrosive type of fertilizer, which we recommend. They might be able to tell you where to get it locally.

Dear Mr. Rodale:

On page two and three of August Organic Gardening, under caption "Unhealthy Weeds" you speak of "seriously harmful weeds," their "good and bad features."

Hesitation in initiating any form of controversy may or may not be a virtue. Believing however that the fundamentals involved in Organic Gardening are being violated by the foregoing expressions I ask leave to state my cause.

In the universal law of balance there are no poisons, no discord. Imbalance is effect of an infraction of law.

Dis-cord, dis-ease, is a state of personal imbalance. Ease is a concomitant of balance. As

mind is cause and physique effect, so mental balance precedes physical well being.

When the human race sees nature through Nature's eyes all gardening will be Organic. Paradise is thus re-established.

In conclusion I would add that I do not believe in destruction—no, not of anything. I believe only in constructive effort—in building up, not in tearing down. This is the law of survival to the fit. The unfit is self destroyed. He who takes up the sword commits mental, moral and physical suicide.

Adolf Werum,
Yonkers, N. Y.

Answer

Dear Mr. Werum:

Replying to your letter of January 14th, we are glad to get your view-point. There must be some practical basis for ascertaining the worth or the disadvantages connected with weeds.

We are following the method that is practicable from both a commercial as well as a health point of view. We still believe that noxious weeds, such as the ones that cause hay fever, certainly should be eradicated, but Sir Albert Howard some time ago wrote an article in our magazine in which he took a very interesting stand about weeds and we are going to mention a few paragraphs from it, as it is very much to the point:

"The nitrates and other soluble salts left in the soil by the crop are absorbed by the weeds and immobilized in the form of easily decomposed organic matter. There is therefore no loss of food materials by leaching, and at the same time the energy of sunlight is fully utilized.

"The drying of the surface soil and the removal of food materials by the weeds helps the crop to ripen, a fact of considerable importance in plants like the Onion and Potato.

"The weeds, when dug into the fertile garden soil before the end of the year, are readily converted by the soil organisms into humus which becomes mineralized in time for the next crop in the spring.

"I have just seen a successful example of this use of weeds in the large vegetable garden at Levans Hall in South Westmorland which, under the able direction of the head gardener, Mr. F. C. King, has for many years established for itself a high reputation in local gardening circles. Mr. King tells me that general weeding is always stopped by the end of July, and that in crops like Potatoes, Celery and Leeks, no weeding at all is attempted after the final earthing-up. They not only perform the duties of a self-sown, green-manuring catch crop, but are also of use as indicators of soil fertility. Mr. King judges the condition of his various plots by the way weeds, like Groundsel, flourish!

He regards them affectionately as his unpaid soil analysts. The better they grow the more he is pleased. Indeed, he goes so far as to state that there is no better method of judging a vegetable garden than by the condition of the weeds in October."

He states that "The ambition of most gardeners is to keep their land spick and span like a carefully tended drawing room." But this is not the best way.

Dear Mr. Rodale:

I have been getting "Organic Gardening" since last May and have been very much amused by some of the reader comments as well as interested in the basic principles of your well founded theories.

The Indore method of composting has proven highly successful. I have found that it is satisfactory, where l i m i t e d amounts of material are available at a time, to pile up the leaves, rakings, grass and weeds until enough material and time is available to build a heap. I have stood very little loss in this way and have already realized improved results. In a patch forty by seventy feet I have raised all the vegetables for a family of four to seven in my spare time over the last eighteen years. This includes all our winter canning and root vegetables exclusive of potatoes. Last Spring I gave away two hundred pounds of chemical fertilizer and got five crops of string beans maturing between June 8th and frost with very little trouble from the Mexican Beetle. Next year will tell the story more completely.

There are three questions on which I will appreciate your opinion:

1. Is the use of Rotonone 75 for the control of all types of beetles injurious to beneficial fungae, earth worms, etc.?

2. Is the use of anthracite coal ash, in limited amounts on the soil in the winter and in the compost, beneficial or injurious?

3. Enclosed is a copy of an advertisement for an "Organic Chemical" called S p e r g o n, which is applied to seed before planting. Is this fundamentally sound or is it "one of those things?"

I was interested to have a clear opinion from your last issue regarding the relative

merits of plowing and surface scratching. My soil is in such good workable condition that I spade deeply with a fork with very little effort thereby maintaining a good deep topsoil. Though I have used chemicals considerably the last few years I have continually built up the soil with manure and plain rotted compost. I shall be interested in this year's results from the standpoint of blights from which we have suffered severely in this locality in the past few years.

Henry G. Schauffler,
New Britain, Conn.

Answer

Dear Mr. Schauffler:

Question 1. Rotonone—We would not recommend the use of Rotonone to anyone who loves the soil and wants to treat it with affection, since this insecticide comes from the ground roots of several tropical plants which are used in those countries to paralyze fish and make them easy to snare.

2. Instead of anthracite coal ash, we would suggest the use of peat moss, which can be purchased in all seed stores. There are strong elements in coal ashes. To loosen up a clay soil, some sand could be incorporated with it also.

3. Your circular on Spergon was not enclosed but many of these special preparations to apply to seed before planting, do not do any good. This is especially true of the Vitamin B1 preparations for plants. On the other hand such a product as you mention might not do any harm. There are many seed treatments consisting of preparations to prevent plant disease and these as a rule are poisonous and are especially not to be recommended.

Dear Mr. Rodale:

Dr. Oliver advises against the use of citrus fruit rind in the compost heap because he says it is harmful to earthworms. Do you believe this is so, and should I throw the rinds in the garbage instead of in the humus pile?

I have put a few tin cans in the humus pile. They have rusted and crumbled up into a fine powder. Is this a good way to add iron to the soil? In your November issue under "The Petty Humic Compost Bins" they say keep tin cans out, but Dr. Ehrenfried Pfeiffer says put a few in.

You mention that a certain amount of waste paper can be put in the compost pile. Is this simply for bulk and aeration or does paper have mineral value?

N. J. Barrett,
Longmeadow, Mass.

Answer

Dear Mr. Barrett:

We have found it perfectly safe to use citrus fruit rinds in the compost heap. The ordinary earthworm, that is in the soil, is rarely found in compost heaps. In the latter there is usually formed the red manure earthworm which dies anyhow before the composting process is completed. We have at various times used much orange skins in our compost and they have decayed beautifully.

I do not think there would be any objection to putting a small quantity of tin cans in a compost heap if they will crumble. If they do not it will cause some trouble. We have never tried it, but will sometime this summer and see what happens.

Regarding waste paper, we do not think that a deliberate effort should be made to put paper into the compost heap, but sometimes where it cannot be helped and some paper does get into the heap, it will not cause much trouble. Paper has been treated with chemicals in bleaching and has poisonous elements in the printing ink but the quantities are so small that it is nothing to worry about.

Dear Mr. Rodale:

We have been very much interested in your article on page 8 of Nov. "Organic Gardening" "Our Corn Crop." Since last fall we purchased a farm of 66 acres and are anxious to build up the soil to raise better and bigger crops, we will have around twelve head of milk cows and fifteen head of sheep and two brood sows. We would like to know how to go about getting the best benefit from the stable manure from these animals. We are feeding alfalfa and shredded fodder besides the ground feed.

Mrs. E. M. Hanly,
Mechanicsburg, Ohio.

Answer

Dear Mrs. Hanly:

It would be impossible in this letter to give you full instructions on how to run a complete farm on the organic basis. If you have sufficient help and sufficient organic material, it would be advisable to start your whole farm on the organic method, but in the event that you do not have such a condition, it is usually advisable to start a small portion of your farm that way. Personally, I believe that if the farmer uses his wits, there are plenty of

ways of getting organic material especially at this time when most farmers are asleep to the value of such material, which is going to waste all around them. If you have any particular problem, please let me know.

Dear Mr. Rodale:

For half a century I have been gardening—in flowers, vegetables, trees and weeds—in a small way. My method appears radical to all who see it for the first time—the results phenomenal. In one of your magazines there was a letter from the San Francisco peninsula—near San Mateo I believe—indicating the same, or a similar method. Its simplicity should make it worth any interested person's experiment.

Beginning with any piece of ground having drainage, prairie, woods, or swamp—I trench it. Soil and drainage conditions determine depth and width of trench and mound. All organic matter I leave in the mound. I sow or plant in the trench. As the plants grow I draw earth around them from the mound. At the end of the season the trench and mound have changed places. All refuse—leaves, cuttings, garbage—I lay in these trenches. In spring I draw soil from the top of the mounds over the refuse. On this I sow and plant and proceed as before.

The Ross "No Weed" Gardening Method reminds me that a resident of Scarsdale pursued my method of gardening last season. Results were extraordinary so that his neighbors are going to copy. No more leaves or refuse is being burned in this neighborhood.

Adolf Werum,
Yonkers, N. Y.

Answer

Dear Mr. Werum:

Your method seems very interesting but if you place raw organic matter in the mounds you must be sure to plant nothing in such material until it is thoroughly decayed, otherwise there may be danger to one's health in eating food raised in such "raw" material, especially if it is garbage.

Mr. J. I. Rodale:

This was my first crop year and never used poison sprays of any kind, only agricultural lime on cabbage and cauliflowers. Now I am looking forward to a real crop next year, as I made a compost pile 40' long and 12' wide. It is covered with three feet of hay for the winter and last summer I took out ½ ton per week of green waste from a store. After finishing my compost pile, this waste was put in a pile for composting next year. Will that be alright or have you any other suggestions of handling the waste for next year's use as we want to compost it before using same.

H. R. Weldon,
Toronto, Canada.

Answer

Dear Mr. Weldon:

Regarding your question as to green wastes, it does not hurt if this waste remains in a separate pile for a period of months to wither. In fact, this is a definite advantage in making compost. It is much better to allow such material to wither rather than to use it fresh in the compost heap. However, to make compost it is necessary to mix animal matter with it; otherwise, you will not have the quick bacterial action. A heap of green matter alone would take a long time to decay. It does not seem to hurt much if the green material is allowed to stay in piles before composting, for reasonable periods of time.

Editors Organic Gardening:

In one article I note that the compost heap may be enclosed by a wooden box "without bottom or top", if space is left between the boards for ventilation. In another article in regard to compost storage the use of "corrugated iron or asbestos—cement sheets" is mentioned. Does the latter imply that boards used to enclose a compost heap would deteriorate too rapidly to be practicable? If wood is used would there be any objection to having a permanent roof over it supported, say, by corner posts set in concrete and high enough so as not to interfere with the turning of the pile? While we have many months with no precipitation except heavy dews, when the rains come they are apt to be very heavy and prolonged.

I have been told that ashes from eucalyptus wood should not be used in a garden because of some deleterious residue it contains. Is this true? If so,

should eucalyptus leaves be used in a compost pile? And how about trimmings from cypress?

Is there any danger of noxious results in vegetables from the use of gopher poisons in ground where vegetables are grown? Our western gophers cause a good deal of havoc at times.

M. B. Marks,
Pacific Palisades, Calif.

Answer

Dear Mr. Marks:

I believe that wood is used more often than iron for purposes of enclosing compost heaps and it will take a long period for it to deteriorate. It may be an advantage to have a cover, such as you suggest, for a heap.

You are correct about the eucalyptus and it is best not to use it. I understand it is also distasteful to earthworms. We would, therefore, say definitely that the eucalyptus leaves should not be used in the compost pile. All parts of trees should be pretty well ground up before placing in a compost pile, as twiggy material will take very long to decay.

Regarding gopher poisons, there would be definite danger in growing vegetables in such ground. There are ways of trapping gophers without the use of poisons.

Organic Gardening:

I have read with great interest your articles on how to make compost, and have followed your directions in making my compost pile.

You state that it is most desirable to put the compost pile right on the ground, and I have done so. But my only available gardening space is on property where large trees are growing. In digging out the compost, I find that the trees have spread their roots into it, so that the pile is run through with a system of little branching roots.

Will you please advise me what to do? What would be best for me to put on the ground under the pile to prevent the roots from penetrating?

Martin O. Moe,
Honolulu, Hawaii.

Answer

Dear Mr. Moe:

It is too bad that you do not have a place for your compost pile away from a tree. We have made several compost piles partly under a tree and did not seem to have that trouble in our climate.

You might first put about six or seven inches of tree branches on the ground before you apply the compost material. I am sure that the roots would not go through these branches. This is also a good thing to do in general, as it provides aeration to the heap.

A neighbor of ours instructed a boy to make a compost pile and he put the material right up against and completely around a young tree that had been out for only about a year or two. The compost killed the tree.

Gentlemen:

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1944. Sure enjoy reading and putting some of the ideas to use. Last year I did not dig or plow my garden. When I was ready to plant I just got out my little hand push cultivator to mark the rows just went down deep enough to plant the seed. And had a wonderful garden. When the garden is growing and the weeds are coming I make a row across the garden and pile the weeds and grass cuttings, also chicken manure and cover it up with dirt and water.

In the spring I pull these piles all over the garden. I do not burn any of the v i n e s, weeds or corn stocks but make a mulch to put around my black raspberries. I do not spray any more for potato bugs I just knock them in a large pan and then put a little coal oil on 'em. Last year was the first time I have seen a toad in my garden in the last 15 years. Now as to spraying the trees I think the best idea is let the birds do the work, why not put up a bird house in each large tree or if the trees are smaller a bird house for Wrens one for each three trees.

Geo. Wargo,
Streator, Illinois.

Gentlemen:

I have been a subscriber to Organic Gardening for the past year, but due to the demand for manure by the farmers of this section, I was unable to get any until too late to apply to the regular crops. However, I completed one pile about August 1st. and used it in growing Chinese cabbage, which was wonderful. My garden plot is about half an acre in extent.

I found the compost dark, well broken down and odorless, when complete. Two years ago I placed a pile of manure in the middle of the garden some time in November or, as soon as I could get it. The following spring a volunteer tomato plant came up thru the edge of the manure pile (the seeds probably passed thru the horses undigested) and, as we had a regular siege of aphis or aphids, all the other plants that I set out were ruined by them. But not the volunteer plant. That didn't have any on at all. And this year another volunteer tomato plant came up on the edge of the uncompleted compost pile. It was the most prolific, healthiest and pest-free plant in the whole garden.

Before I purchased this place, about 5 years ago and to which I retired 18 months ago, the former owner was one who believed in using all the artificial fertilizers and poison sprays in the market. When I had the garden ploughed I couldn't find an earthworm. After placing the compost, altho rather late in the season, there were many earthworms. I started two more piles during October or, as soon as I could get the manure and which I hope to use next spring.

I am fully convinced that the pests do not care for well-nourished, healthy plants and that the Indore method of Composting is the answer.

E. G. Manning,
Woodbury, Conn.

Dear Sir:

Enclosed check to cover subscription to your fine magazine for another year. I want to commend you heartily in your fine work and wish you every increasing success.

Your article of comment on Faulkner's "Ploughmans Folly" is very good. My question, if ploughing is not needed would be, why were spades ever invented to turn the soil if soil does not need turning? There are of course instances where ploughing actually does harm, but to make a broad statement of that sort is sheer nonsense in my opinion.

The method and time of ploughing however, is an extremely important factor. I have used the Roto Tiller in our particular soil at a certain time resulting in a down right destruction of the soil for a whole season, and therefore I caution users against a promiscuous use of the Roto Tiller. As you say, it does kill earthworms which is serious and in my opinion, based upon council given me in the matter of the preparation of foods, the high speed friction to which the earth is subjected is also contrary to best interests of the soil bacteria.

In discussing preparation of foods with an expert dietician some time ago he stated that the subjection of foods to high speed frictions such as produced by our electrical appliances is definitely harmful to the vital life-giving bacteria and consequently results in devitalization of our foods to a very serious extent. This is in line with my own reasoning.

I have used with excellent results so far, a rotary plow made by the Gravely Mfg. Co., Box 1007, Dunbar, W. Va. As far as I know they have made this only in a size about that of a Roto Tiller. If this principal could be enlarged upon, I believe great good could be accomplished. It is true that the speed, while much lower, is also possibly injurious to earth-

worms but in a relatively smaller measure. The soil is not subjected to the same "whipping" effect and is rendered much more porous and still ready for immediate planting. I feel the use of it should be encouraged. I heartily agree with you that the factor of foremost importance is organic content of the soil. The health of the soil as set forth in the remarkable debate in the House of Lords as recorded in your last issue is captivating indeed. I am a profound lover of the soil and consequently interested in its welfare. I have been hoping something could be established in these parts in the way of a demonstration farm in the use of organics only. Should you be in possession of any information about others likewise interested hereabouts, I would be delighted to learn of them.

Paul Pfund,
Landscape Gardener,
Elmhurst, Illinois.

Answer

Dear Mr. Pfund:

We are demonstrating the Organic way of farming on our farm of 63 acres, which has now completed a little over two years with it. There are many other of our readers who are beginning to follow it and from time to time they will report through the columns of ORGANIC GARDENING.

Recently the Horticulture School at Ambler, Penna. has taken it up and this coming spring intends to set aside some acreage, part of which will be farmed with commercial fertilizers and part with compost. It will be interesting to see the results.

Gentlemen:

Please send me to above address two copies of Sir Albert Howard's "An Agricultural Testament" for which is enclosed check for $7.00.

I hope you will continue the issues of "Organic Gardening" as it fills a long felt want. It took me about a year to find out what the "Indore" method of composting was, and then only tracked it down through an article in the Rural New Yorker, and writing to the author through the paper. The writer was a Canadian, and enabled me to get the whole story. I have used it now for over two years and have had some surprising results. I do not think there will be a great expansion of this method among American farmers until some simple machinery is devised to take the drudgery out of making the compost, and believe that when supplies are available, some system such as we use in blending wool batches can be worked out that will put the operation on a par with filling a silo. I have made a compost heap each year for three years, strictly following directions but have not yet succeeded in getting a high temperature. It has turned into good compost but has not been hot enough to kill weed seeds or diseased vegetation. I used the three layers with good wood ashes, placed posts for ventilator holes, and wet the heap thoroughly, but the temperature did not go over body heat. Can you suggest any reason?

H. M. Ashby,
Kinderhook, N. Y.

Answer

Dear Mr. Ashby:

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Organic Gardening
Emmaus, Pa.

ize the compost heap, but it will be expensive and will be practical only for farms of a few hundred acres unless farmers could get together and own such a machine in community.

Regarding not quite high enough temperature to kill the weed seeds, some factor in the making of the heap may be wrong. It may be that the heap is too wet or possibly it is in a location where the winds dry it out too much. Theoretically, the compost heap should be in a sheltered place, protected on the North, East and West side.

Your solution might be to allow it to stand longer, possibly an additional month or two.

Another point is that the green matter that is used in the compost heap should be withered first. This makes this material more compact. Another mistake that some people make is to use too much earth in between the layers. There should be a bare sprinkling of not more than one eighth inch in thickness. The top layer, however, should be much heavier and should cover the top and the sides. Please re-read the instructions for making compost and check each point carefully. To stimulate the bacterial action, why not, in addition to a thin sprinkling of earth, add a small amount of finished compost with the earth, wherever you use it in the heap, but not in the top layer.

Gentlemen:

Enclosed find check for $3.50 for which please send me the Sir Albert Howard book "An Agricultural Testament."

Several of us here, are keenly interested in this forward surge of true conservation and we have inaugurated a "Compost" period in our Magnolia Circle of the St. Petersburg Garden Club, in order to help spread what we believe and know to be the real answer to the future of our Florida soil problems. All else is makeshift and mostly harmful. Man's propensity for "cleaning up" land for developments is fast making desert of many areas here and drainage projects, aside from the devastation of water and woods supplies inevitable in city and town building bid fair to really make waste what nature did her best to make the land of flowers—Florida.

Thanks to you for your part.

Margaret Walmsley,
St. Petersburg, Florida.

Dear Mr. Rodale:

About 25 years ago when I worked in South Dakota we practiced the Faulkner method by disking our corn land. Once over with the disk followed by a 24-ft. wide drag prepared the soil for small grain.

Ploughing would take 8 horses to pull three 12-inch bottoms but only four horses were used on the disk. Therefore it was at least four times quicker to disk than plow. That, I suppose was the sole reason for disking.

Production on corn land was so much higher than the other land that the boss regarded planting corn as fertilizing. He aimed to go over all his farm with corn every five years.

Was the production higher simply because he did not plough?

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Another Faulkner method we used was in breaking new land. The boss told me that in pioneering days it was quite a task as they turned the virgin soil under very deep and waited until the following year for a crop. Then a newcomer just barely "skinned" the soil and all the farmers laughed, saying he was wasting his seed. The crop was a bumper one however and that revolutionized breaking new soil in that country.

Otherwise they are far from the Faulkner method. All our fertilizer from 16 horses, four cows, 250 pigs, chickens, etc. was unloaded in the pasture as that was the shortest haul. All straw stacks but a few reserved for winter bedding were burned. It is quite a sight at harvest time to see hundreds of fires in all directions, but it would break a compost farmer's heart.

Let us have more controversial questions. They liven up your magazine. Here are a few. Harper's in a seed article said China's agriculture was so amazing because they had 4,000 different crops. We have about 400 and should have 800.

Sat. Eve. Post says you can smell Chinese farms before seeing them as they use night soil directly on the land, is that right?

Business Week says they have used rotenone for centuries in China while we have used it but a few years. I thought they never dusted or sprayed.

Finally, don't fail to read that article about Umbrella Ants in a back number of National Geographic. The ants make their own compost to raise food.

John O'Hearn,
Hornell, N. Y.

Answer

Dear Mr. O'Hearn:

The question of plowing or no plowing is a very complicated one and we feel that the government is fully aware of the controversy. Some of the Department of Agriculture Officials have expressed themselves as favorable to Mr. Faulkner's theory of no plowing, whereas other officials and professors of agriculture are violently against it. We feel that because of this the government is going to experiment and within a few years there will be a more practical basis for making a decision. Many farmers now are also experimenting with it. Our advice, however, is to try the no plowing method, if you are so inclined, on a very limited basis.

It is interesting to hear about China's amazingly large number of crops. Without going into the matter too deeply it would seem to me that whether a country grows only 400 crops or 4,000 would not be a practical factor. In fact it would seem to me that the reverse should be true, to have less crops but to study them more in detail and be more efficient with them.

The average Chinese farmer, through centuries of tradition has learned that night-soil must be composted before it can be safely used on the land. However, no doubt, there are some who might transgress this natural law and then there would be serious trouble.

Chameleons in the Garden

I wonder how many know that chameleons are a wonderful help to the flower grower. For years I thought them interesting little things as I saw them darting about the plants or crawling out on the steps to get their sun bath and become the counterpart in color to whatever they were on. Then one day I noticed a large Lucerne begonia swaying and went over just in time to see a chameleon devour a good sized worm. Then I watched as he very carefully went over the plant, leaf by leaf, both sides being thoroughly inspected before he went to another leaf. He got two winged bugs before he went on to the two large gallery boxes of impatiens, looking them over carefully also.

In the intervening years I have caught all the chameleons I could find and have brought them home. They have eliminated spraying, keeping my plants free from all pests.

When late Fall comes the plants go down in a pit for the Winter and I am careful that the chameleons go along, too. They thoroughly enjoy the warmth and frisk about happily. It is surprising how far they can jump, especially if some cruising butterfly has wandered in to sip at a flower. They make short work of it.

They seem to be high tempered among themselves. When angry they let down a reddish bag under their throats and pounce at one another's heads. Yet in all my handling them never have I ever known one to offer to bite. They very quickly become tame and will crawl off a plant to be on my hand, becoming flesh colored in an incredibly short time.—Marie E. Simpson, Biloxi, Miss. —*Horticulture Magazine.*

AN AGRICULTURAL TESTAMENT

By Sir Albert Howard, C. I. E., M. A.

Formerly Director Institute of Plant Industry Indore, and Agricultural Adviser to Central India and Rajputana.

SIR ALBERT HOWARD C. I. E., M. A.

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Health, Indisposition, and Disease in Agriculture

9 Soil Aeration
10 Some Diseases of the Soil
11 The Retreat of the Crop and the Animal Before the Parasite.
12 Soil Fertility and National Health

Part IV

Agricultural Research

13 A Criticism of Present-day Agricultural Research
14 A Successful Example of Agricultural Research

Part V

Conclusions and Suggestions

15 A Final Survey

Appendixes

This is the recognized standard text book for gardeners and farmers who wish to change from the use of ordinary chemical fertilizers to home-made organic fertilizers. Sir Albert Howard has forty years of active experience in the field of organic fertilizers and is the accepted leading authority on the subject.

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